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gricultural Extension Service

GUIDELINES FOR

Conducting Extension Vegetable Trials

A Guide for County Extension Personnel

Texas Agricultural Extension Service • Zerle L. Carpenter, Director
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GUIDELINES FOR CONDUCTING EXTENSION VEGETABLE TRIALS

A GUIDE FOR COUNTY EXTENSION PERSONNEL

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The information contained in this publication provides guidelines for conducting vegetable variety evaluations and/or demonstrations by county Extension faculty. Demonstrations are one of the best educational tools available to the agent. Consequently, they should be a vital part of every agent's proactive educational program.

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Field trials and demonstrations serve as a means of introducing new varieties, methods, or concepts to the local audience. They also offer the agent an opportunity to work closely with cooperators (usually leaders in the community) and agri-industry representatives. Perhaps most importantly, they provide visibility and respect for Extension programs in the county.

Selection of a Cooperator

The success or failure of any field demonstration is closely related to the individual selected as a cooperator. Demonstrations may be lost or of limited value, because of a communication failure between the agent and the cooperator.

It is very important to clarify responsibilities. To minimize the chances for failure because of poor communication, state the demonstration agreement both verbally and in writing. Confirm the appropriateness of the agreement with your County Extension Director and/or District Agent, and reproduce the form on your letterhead. A sample agreement form may be found in the back of this bulletin.

First and foremost, the cooperator should be interested in the project and willing to contribute to the success of the demonstration. An experienced grower, preferably of the vegetable to be evaluated and one of the better managers in the county, should be selected whenever possible.

Try to work with as many different cooperators as possible. This allows varieties or concepts to be evaluated under different field and management conditions as well as providing the agent with a broader base of support for his program.

Responsibilities of the Extension agent and the cooperator may vary from one demonstration to another. In general, the Extension agent is responsible for the following:

- Obtaining seed or transplants.
- Establishing the plots and providing the cooperator with a field map and treatment codes.
- Keeping yield and other records and observations.
- Arranging for field days and other activities related to the plots.

- Summarizing the data, preparing a report, and disseminating the information. The cooperator should receive a copy of this report.

The cooperator is generally responsible for:

- Providing land.
- Providing management and maintenance inputs such as crop fertilizer, mulch, fumigation, weed control, and pest control.
- Culture of the demonstration plot should be the same as for the cooperator's crop, and in accordance with Extension recommendations.

SUPPLIES AND EQUIPMENT

Demonstrations should not require expensive or elaborate equipment. Some items are necessary for most demonstrations while other items are specific to certain vegetables.

Most of the items needed are available from several sources, including laboratory, forestry, or horticultural supply companies as well as local hardware, discount, and garden or farm supply stores. Occasionally, certain pieces of equipment may need to be constructed to meet the requirements of the demonstration.

Necessary supplies may include:

Wooden labels - 10 to 12 inches in length for identifying treatment in the field.

Seed envelopes - clasp-type for easy resealing.

Marking pens and pencils - weatherproof type.

Flagging tape or tags for labeling picking buckets, plots, etc.

Paper bags - heavy weight, various sizes for harvesting small plots. Plastic buckets and/or bushel baskets may be required with larger commodities.

String - to align field stakes.

Flags - 2 to 3 feet, can be color coded to mark plots for easy identification.

Planter flats or other transplant trays - 1- to 2 1/2 - inch cells will accommodate most vegetables.

Stakes, cages and string - for crops requiring support (usually supplied by cooperator).

USDA Standards for Grades of the various commodities. Order publication directly from:

Fresh Products Standardization and Inspection
Agricultural Marketing Service
U.S. Department of Agriculture
Washington, DC 20250

Data sheets - individually designed sheets for each crop.

Steel or fiberglass tape - 100 feet or more for laying out plots.

Marking wheels or sticks - convenient distances for in-row plant spacing.

Hand-seeder - Planet Jr., Cole, Earthway, Esmay, or adapted precision-type seeder.

Plastic mulch punch - 2 to 3 inches in diameter for making plant holes in mulched beds.

Picking buckets - nesting, plastic buckets of about 1/2 bushel capacity are easy to store and clean, may be supplied by cooperator.

Scales - preferably hanging, milk type with 20- to 60-pound capacity, or household or platform with 12- to 60-pound capacity.

Tripod - folding or rigid for supporting hanging scales.

Rulers and yardsticks - heavy duty, accurate measurement.

Calipers - available in sizes to measure cherry tomatoes to watermelons.

Fruit sizing rings - may be purchased or made to conform to USDA grade specifications (cantaloupe/honeydew).

Assorted knives - for harvesting.

Camera - for photographing plots and harvested crop.

Refractometer - hand-held type for soluble solids determinations (muskmelon/watermelon).

Establishing the Trial

Demonstration trials should be conducted "in season;" i.e., planting should be at the normal time in your area for the crop being evaluated. Consequently, definite plans should be made well in advance of the anticipated planting date. All seed and other supplies required to conduct the trial should be obtained at least one month prior to the anticipated planting date.

There are at least two general procedures that can be followed in trial establishment depending upon size of the cooperator's operation and/or treatment limitations such as seed sample volumes.

1. Mark out a representative plot of the required size which the cooperator will leave for you to seed or transplant by hand or with small equipment. It usually works best for the cooperator to plant the field and the demonstration area immediately thereafter under the agent's supervision. This requires advanced coordination and continued communication with the cooperator by the agent.

2. Where seed supplies are plentiful and the crop is mechanically established, the plots can be seeded in rows with the cooperator's equipment. After emergence, uniform areas in the field can be selected for observation, yield and other appropriate measurements.

It is essential that all plots be clearly marked with field stakes and flags. A field map showing all plots and surrounding areas should also be developed and a photocopy given to the cooperator. Most trials will be in the field at least three months. Small field stakes and flags often disappear over a period of time.

Randomized complete block design is most frequently used for trials. Plot size and number of replications are determined by the variability of the site and the plant material or treatments being evaluated. Four replicates are generally satisfactory and acceptable. Plot size or the number of plants per plot is less definite and harder to establish with certainty. For tomatoes and peppers, 8 to 12 plants might be satisfactory, whereas 60 to 100 plants might constitute a minimum-size bean plot. In any event, guard rows (beds planted on either side of the test plot area) will help reduce variability and thereby increase precision. It may be useful to allot space at the beginning of the trial to be left unhar-

vested to show to field day participants. Observation rows (left unharvested) are especially useful for leaf and root crops that are destructively harvested. See the individual crop section for specific suggestions on plot size.

Other than for demonstration purposes, all trials should be conducted using randomization and replication. This will enable the greatest level of accuracy in evaluating the trial data. When trials are set up properly, valid statistical analyses of the data can be accomplished.

Begin the randomization process by arbitrarily assigning a code number to each variety or treatment.

Example: 5 varieties - (Sweet Wonder, Big Girl, Star, Gold Nugget, Desirable)

Code No. 1 = Sweet Wonder
2 = Big Girl
3 = Star
4 = Gold Nugget
5 = Desirable

Each of these code numbers must be randomly placed within each of the replicates to be established. In our example we will have 4 replicates. To simplify the procedure, draw up a blank field map depicting all reps with a slot for each treatment or variety entry.

Example:

Rep. 4	← Guard Row						→ Guard Row	
Rep. 3								
Rep. 2								
Rep. 1								
Bed No.	1	2	3	4	5	6	7	

The order of placement (randomization) of each variety (treatment) within each replicate can be determined using several techniques such as: computer generated programs, dealing playing cards, dropping plot markers. The com-

puter generated order develops a random order of numbers for each replicate. Place each of these accordingly on your field map. Remember, always begin left and proceed to right. With playing cards, each suit can represent a different replicate. Upon dealing out the cards, place each number in the appropriate place as they are dealt out.

Example:

Rep. 4	Guard Row	5	3	1	2	4	Guard Row	
Rep. 3		3	4	2	1	5		
Rep. 2		4	1	5	2	3		
Rep. 1		1	2	3	4	5		
Bed No.	1	2	3	4	5	6	7	

All plots should be identified with plot markers. These markers can be used to assist in the randomization process. Make up a marker labeled with the rep number and the treatment number. Sort all like rep numbers into a bundle. Drop each bundle separately and pick up each marker randomly. Assign a spot on the map in the appropriate rep in the order that the marker was picked up.

Remember, for a field design to be valid statistically, each replicate must touch another rep at some point as do all treatments (plots) within each replicate. Therefore, always select uniform spots in the field large enough to accommodate all replicates of the test. For assistance in analyzing your data and for advice on appropriate statistical analysis, contact your vegetable specialist.

Sometimes it may be unrealistic to plan a replicated trial for certain vegetables that require frequent and multiple harvests such as summer squash and okra. In these cases, single plots of each variety, two or three times larger than that suggested in the individual crop section, may be used.

Reporting Yields

Frequently, a perfect stand at the predetermined in-row spacing may not be obtained. Large deviations in plant

stand among varieties may cause faulty results and interpretations to be made. Therefore, stand counts should always be made and subjected to statistical analysis. It is more meaningful to report the plant stands and actual yields rather than calculated yields based on a perfect stand. Calculated yields may be exaggerated because of reduced in-row plant competition.

Yields can be reported on a plot basis, per acre basis, or per 1,000 linear bed feet (lbf). Plot yields provide a good comparison among the varieties or treatments being evaluated. However, comparisons cannot be made with state average yields or with grower yields since they are expressed on an acre basis. Thus, there is some advantage to expanding plot yields to acre yields. Where wide row cultural systems are used, it may be more useful to express yields per 1,000 lbf.

Photographic Record

Photographs or slides are an important part of the record-keeping process of all demonstrations. Photos that depict plot establishment, plant emergence or transplanting, harvest, striking differences among varieties in disease susceptibility or performance, and harvested plant products are extremely useful for future Extension meetings and publications. Treatment or variety labels should be legible. All labels should be prepared beforehand in the office so they are available for photographing plots at the appropriate times.

Variety Trials/Demonstrations

Grower demonstrations should include a limited number of varieties or treatments. The actual number of varieties may depend on the following considerations:

- The number of new varieties available in a particular crop.
- Resources that are available, including land, and harvest labor.
- Harvest frequency required by the crop (example: A crop such as cucumbers that requires harvesting several times a week may necessitate having fewer varieties than once-over harvested vegetables such as potatoes or carrots).

The standard, recommended local variety(ies) should be included in all variety evaluations as a basis for comparison with the newer varieties or breeding lines. The same holds true for concept demonstrations.

The decisions on which varieties to include should be made at least two months before the planned planting date. This should allow sufficient time to acquire the needed seed. Extension vegetable specialists and seed company representatives are available to assist with variety selection. Request seed of varieties known to do well in your area. Have the varieties prioritized in case you don't have room or resources to try all of them. Obtain as much information as possible from the seed company about their seed, including germination percentage, seed treatments, expected days to maturity, and so forth. This may influence your seeding rates or plot design. It may also explain any later problems in stand establishment and seedling vigor.

Obtaining Seed

Most seed companies are eager to cooperate in Extension trials by supplying seeds in exchange for a written report of the results.

Remember, a trial is not complete until the report is written and the results sent to the seed companies who supplied materials to be evaluated. The cooperator and the vegetable specialist should also receive a copy of the trial report.

Seed of hybrids is generally available from the developing company and associated dealers, whereas open-pollinated varieties may be available from a number of sources. The major sources of vegetable seed are listed in the Vegetable Growers Handbook. The Extension vegetable crops specialists are able to supply names of specific contact people at many of the seed companies.

Trials requiring transplants such as tomato and pepper in many parts of the state entail some additional logistical problems as compared with trials of direct-seeded crops. One solution is to supply seed of the varieties to be evaluated to a cooperating bedding plant producer or to the grower for transplant production.

Seeds or transplants must be available in time to fit into the grower's planting time for the trial to be a success. Advanced planning is absolutely necessary.

Guidelines for Evaluation of Specific Vegetables

In a replicated trial, each replicate should contain a plot of the suggested size, for all treatments and entries.

Snap Bean

- Plot size
  - 10- to 20-foot row
  - 2 inches in row plant spacing on 38- to 40-inch beds
  - 1 plant row/1 bed
- Number of harvests
  - 1 to 3
- Data acquisition
  - days to first harvest
  - yield, expressed as 30-pound bushels (early yield for multiple harvest plots is desirable)
  - plant height
  - pod length
  - pod shape: round, oval, or flat
  - pod straightness: qualitative
  - pod color: qualitative
  - pod removal force requirement: for machine harvest
- Observations
  - insect problems
  - susceptibility to disease
  - susceptibility to iron chlorosis in areas of high pH.

Broccoli And Cauliflower

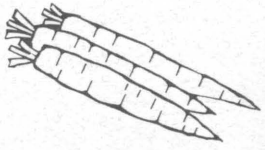
- Plot size
  - 20 to 40 plants spaced 6 to 12 inches apart
  - 1 to 2 plant rows/38- to 40-inch bed
- Number of harvests
  - usually 1 to 3
- Data acquisition
  - days to first harvest
  - early and total yield expressed as 23-pound cartons
  - head or curd diameter
  - head or curd weight
  - number of harvests

- percent marketable

- Observations
  - susceptibility to disease and disorders such as hollow stem
  - uniformity
  - head tightness
  - head cover
  - head shape (domed)
  - head leafiness
  - head color
  - broccoli bead characteristics

CABBAGE

- Plot size
  - 20 to 40 plants spaced 6 to 12 inches apart
  - 2 plant rows/38- to 40-inch bed
- Number of harvests
  - 1 to 3
- Data acquisition
  - days to first harvest
  - yield expressed as 50-pound cartons or crates
  - average head weight
  - core length
  - head tightness
  - plant color
  - head shape
  - percent marketable
- Observations
  - susceptibility to disease
  - incidence of tip burn



CARROT

- Plot size
  - 2-row bed, 20 feet long; the center 8 to 10 feet can be harvested or sections can be harvested at weekly intervals to determine optimum pack out. Strive for 1 inch in row plant spacing.
- Number of harvests
  - 1 for each variety at 3/4- to 1-inch shoulder diameter; processing types at 2 inches + shoulder diameter.

- Data acquisition
  - days to harvest
  - yield expressed as 50-pound units or tons/A for processing
  - percent marketable
  - root length
  - root diameter
  - root shape
  - root color (external and internal)
- Observations
  - susceptibility to disease
  - top vigor
  - top height
  - predominance of core

CORN (SWEET CORN)

- Plot size
  - 25 feet long with 12 inches in row plant spacing, 1 row if varieties are of similar maturity, 3 rows for pollination if varieties differ widely in maturity. Endosperm types should be separated at least 500 feet, if possible.
- Number of harvests
  - usually 1 for each variety
- Data acquisition
  - days to mid-silk to estimate harvest date
  - yield expressed as 42-pound crates containing 4 1/2 to 5 dozen ears
  - number of marketable ears
  - days to harvest
  - plant height
  - ear length and diameter
  - husked ear length
  - number of kernel rows
  - tip fill
  - husk cover
- Observations
  - susceptibility to disease
  - lodging
  - ease of snapping

- flag leaves
- kernel color, sweetness, tenderness
- tendency for double ears

CUCUMBER (SLICERS)

- Plot size
  - 12 to 25 plants/entry
  - 1 foot in row spacing on 38- to 40-inch beds
- Number of harvests
  - 5 to 10
- Data acquisition
  - days to first harvest
  - early and total yield expressed as 55-pound bushels

CUCUMBER (PICKLING)

- Plot size
  - 20 to 40 plants
  - 6 inches in row spacing on 38- to 40-inch bed
  - 1 to 2 plant rows/bed
- Data acquisition
  - Pickling Cucumber Improvement Committee (PCIC) values for pickles – four grades:
    - #1's – 1-inch diameter
    - #2's – 1 to 1.5-inch diameter
    - #3's – 1.5 to 2-inch diameter
    - #4's – more than 2-inch diameter
  - fruit weight expressed in tons/A
  - fruit length and diameter
  - fruit color
- Observations
  - susceptibility to disease

LETTUCE

- Plot size
  - 1 bed, 20 feet long x 38 to 40 inches wide
  - 2 plant rows/bed with 6 inches in row plant spacing
- Number of harvests
  - usually 1

- Data acquisition
  - yield expressed as 50-pound cartons containing 24 heads
  - days to harvest
  - head weight and firmness
  - percent marketable
- Observations
  - susceptibility to disease
  - incidence of defects such as cracked rib, tip burn, and bolting
  - ability to hold in the field

MUSKMELON

- Plot size
  - 15 to 25 plants spaced 1 foot apart
  - 6-foot beds with 1 plant row
  - train vines on beds to facilitate easier harvest and to prevent variety mixture during harvest
- Number of harvests
  - 3 to 5
- Data acquisition
  - days to first harvest
  - early and total yield expressed as cwt
  - fruit weight
  - fruit shape and size (small, medium, large)
  - cavity dimensions
  - flesh width
  - soluble solids
- Observations
  - susceptibility to disease
  - fruit flesh color
  - presence of sutures
  - netting characteristics

ONION

- Plot size
  - 2 rows, 10 to 20 feet long with 3 inches in-row plant spacing
- Number of harvests
  - 1 for each variety

- Data acquisition
  - yields expressed as 50-pound bags
  - days to harvest
  - percent marketable
  - bulb diameter
  - neck diameter (10 bulbs of the predominant size)
  - bulb weight
- Observations
  - susceptibility to disease
  - incidence of defects such as bolting, rots
  - curing characteristics

Pepper

- Plot size
  - 20 to 30 plants with 12 inches in-row plant spacing
  - 1 to 2 plant rows/38- to 40-inch bed
- Number of harvests
  - 3 to 5 at full green maturity
- Data acquisition
  - early and total yields expressed as 25-pound bushels
  - days to harvest
  - fruit weight
  - number of fruit per bushel
  - number of lobes
  - wall thickness
  - length/diameter ratio
- Observations
  - susceptibility to disease

Potato

- Plot size
  - 1 row, 20 feet long with 12 inches in-row plant spacing
- Number of harvests
  - 1 for each variety
- Data acquisition
  - yield expressed as cwt
  - days to harvest
  - tuber shape

- skin color
- skin type (smooth, russet)
- specific gravity

■ Observations
- susceptibility to disease
- occurrence of tuber defects

RADISH

■ Plot size
- 3 to 4 feet of row, 36 to 48 plants

■ Number of harvests
- 1 per variety, varieties may require different harvest days

■ Data acquisition
- days to harvest
- average root weight
- proportion of roots in size classes
- marketable yield expressed as 12-pound cartons
- proportion of roots that are marketable
- incidence of defects, splits, cracks, misshapen roots, pithiness, black root rot

■ Observations
- susceptibility to disease
- top characteristics

SQUASH AND PUMPKIN

■ Plot size
- 12 to 25 plants

■ Number of harvests
- summer squash - 12 to 20
- pumpkin and winter squash - 1 to 3

■ Data acquisition
- yield expressed as 42-pound bushels for summer squash and cwt for winter squash and pumpkin; early yield for summer squash
- days to first harvest
- number of fruit
- fruit weight for pumpkin and winter squash
- fruit shape
- fruit color

- Observations
  - susceptibility to disease
  - plant habit

TOMATO

- Plot size
  - 10 plants with 2 to 3 feet in-row plant spacing
  - 6-foot plant beds with 1 plant row
  - should be trellised, caged or staked
- Number of harvests
  - 3 to 5
- Data acquisition
  - yield expressed as 25-pound cartons
  - days to first harvest
  - fruit weight
  - proportion of extra-large, large, medium and small fruit
  - fruit shape
- Observations
  - susceptibility to disease
  - occurrence of fruit defects (cracking, blossom end rot)

WATERMELON

- Plot size
  - 10 to 12 plants spaced 2 to 3 feet apart on 6- to 10-foot beds
  - Train vines on beds to facilitate easier harvest and prevention of variety mixture during harvest
- Number of harvests
  - 3
- Data acquisition
  - early and total yield expressed as cwt
  - days to first harvest
  - average fruit weight
  - percent soluble solids (sugars)
- Observations
  - susceptibility to disease
  - rind characteristics
  - internal characteristics

This information on conducting Extension vegetable variety demonstrations is specific for a limited number of the crops grown in Texas. For crops not listed, use guidelines for similar crops (e.g., for cowpeas, the format would be similar to that for beans). Contact Extension vegetable specialists for suggestions on demonstrations for crops that do not seem to fit these guidelines.

Associated Educational Activities

Much time and effort need to be expended to conduct a successful trial demonstration. Even unsuccessful demonstrations (and there will be some) require much effort. The following suggestions show some of the ways that you can maximize the educational and personal benefits of a demonstration trial.

1. Conduct a grower field day to allow them to study the varieties and/or concepts. A successful field day will require good publicity, personal reminders to key growers, signs directing visitors to the field, well-marked plots, and field maps with treatment codes which are available for distribution. This type of meeting usually works best with only a brief introduction of what is being done and why, followed by self-guided tours through the plots. Be available to respond to questions, but allow the growers to evaluate the varieties for themselves. Some light refreshments will keep the growers around to discuss what they have learned and give you a chance for more interaction (seed sales personnel, agri-businessmen, etc., are potential sponsors of the refreshments).
2. Contact your local farm newspaper editor - pictures and article on the demonstration will inform those growers who were not able to attend.
3. Include demonstration results in your county newsletter. Again, those not attending the meeting will have access to the information, and all growers will have a written record of the final results for their files.
4. Submit your results to the appropriate Extension vegetable specialist.

Acknowledgment

The information presented in this publication was initially developed by Dr. Don Maynard, Extension vegetable specialist, University of Florida, and modified to meet the needs of the Texas agents.

VEGETABLE VARIETY DEMONSTRATION AGREEMENT

Vegetable _____ Study _____

The purpose of this agreement is to clearly establish responsibilities to insure the success, insofar as possible, of the demonstration. Responsibilities of the cooperator include:

_____

_____

_____

_____

_____

Responsibilities of the Extension Agent:

_____

_____

_____

_____

Joint responsibilities:

_____

_____

_____

As part of this demonstration, an extension field day at the site will ____, will not ____ be held.

Signed:

_____ _____

Cooperator Extension agent

_____

Date

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